

Ch. 20 Section 20.9 Electrolytic Cell (Electrolysis)

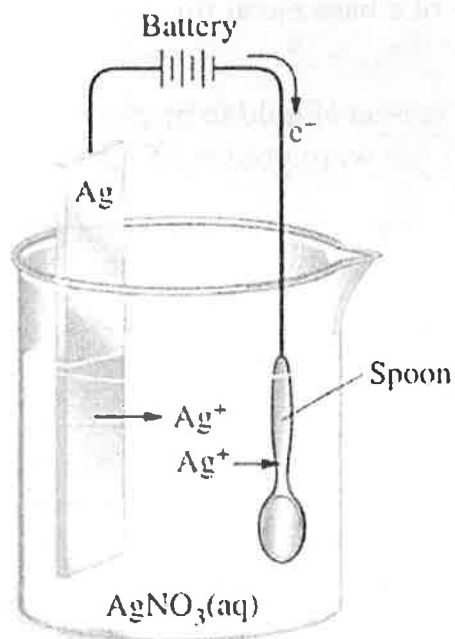
Quantitative Aspect

The External source of energy is the "battery"

Gibbs Free Energy (G) < 0 Voltage (E) > 0 $K \gg 1$

The Electrolytic Cell: The silver plating of the spoon with silver metal

- Gibbs Free Energy (G) > 0 ..supplied from the battery $\Delta G \oplus$ non-spont.
- Oxidation and reduction processes are forced



(#1) How much silver metal will be deposited on the tin spoon in 2 hours with a 5 amp current from the battery? (Silver at. wt. = 108)

2 hr w/ 5 A

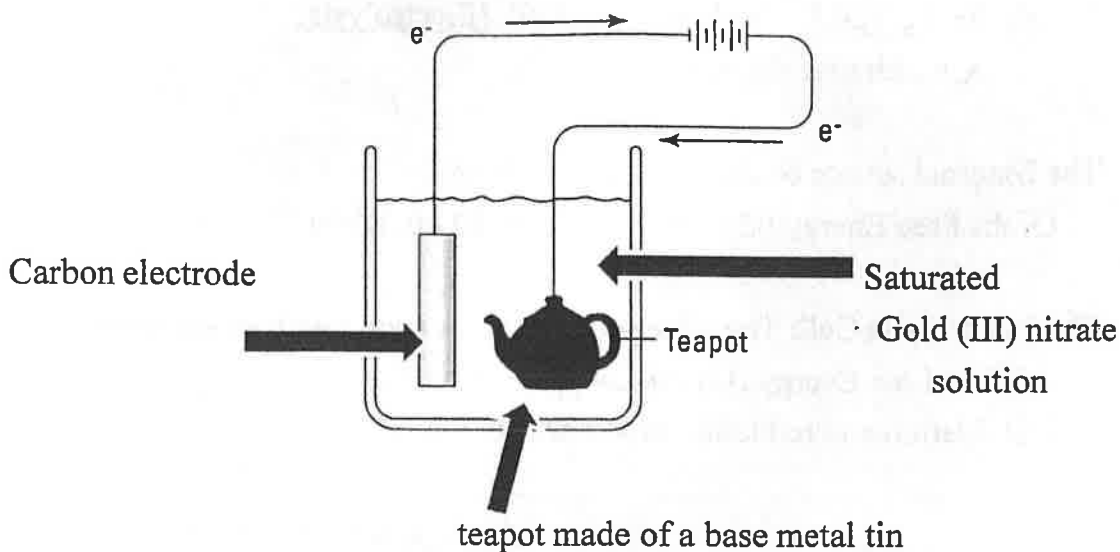
$$10 \text{ A} \times 7200 \text{ s} = 72000 \text{ C}$$

$$\frac{72000 \text{ C}}{96485 \text{ C}} = 0.746 \text{ mol } e^-$$

Ag moves $1e^-$

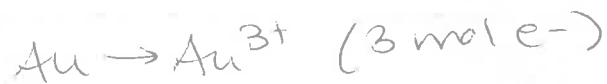
$$\frac{0.746 \text{ mole } e^- \cdot 1 \text{ mol Ag}}{1 \text{ mole } e^-} \cdot \frac{108 \text{ g}}{\text{mol}} = 80.6 \text{ g Ag}$$

(#2)



How long (hours) will it take for 1600 milligrams of gold to be plated on the teapot with a current flow of 1.5 amps? (At wt of gold = 197)

1600 mg Au flow of 1.5 A ? time



$$\frac{1.6 \text{ g Au}}{197 \text{ g}} \times \frac{\text{mol Au}}{1 \text{ mol Au}} \times \frac{3 \text{ mol } e^-}{1 \text{ mol Au}} \times \frac{96485 \text{ C}}{1 \text{ mol } e^-} = 2351 \text{ C}$$

$$2351 \text{ C} = 1.5 \text{ A} \times \text{time}$$

$$\text{time} = 1567 \text{ sec} \rightarrow 0.44 \text{ hr}$$